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UNDERGRADUATE MATHEMATICS CLUBS.

All reports of club activities should be sent to E. L. DODD, 3012 West Ave., Austin, Texas.

CLUB ACTIVITIES.

THE MATHEMATICAL CLUB OF THE UNIVERSITY OF ALBERTA, Edmonton, Canada.

This club was organized on October 29, 1913. The following paragraphs from its constitution outline the form and object of the club:

(1) Membership shall be open to all members of the staff of the University, to graduate students, to honor students in Mathematics and Physics, to third and fourth year students in Applied Science and to fourth year students in Arts.

(2) Meetings shall be held fortnightly throughout the session.

(3) The purpose of the society is the study and discussion of pure and applied mathematics.

The officers for the year 1913-14 were: President, Professor Ernest W. Sheldon; secretary, Professor Samuel D. Killam.

The following papers were presented during the year 1913-14: "Graphical methods" by Professor Killam; "Velocity of the stars" by Ross S. Sheppard Gr.; "Non-euclidean geometry" by George Robinson '14; "Mathematics of investments" by Cecil E. Race, lecturer in mathematics and accounting; "Mathematical approximations" by Ibrahim F. Morrison, associate professor of civil engineering; "The burial of Euclid" by Professor Sheldon; "The theory of least work" by W. Maxwell Fife, lecturer in civil engineering; "Rotations" by R. N. Parsons Gr.

The officers for the year 1914-15 were: President, Professor Killam; secretary, Professor Morrison.

During the year 1914-15 the following papers were read: "Mathematical impossibilities" by John M. Stetson, lecturer in mathematics; "Fundamental units of mechanics" by Robert W. Boyle, professor of physics. "Ionization of gases by collision" by Stanley Smith, assistant professor of physics; "The flight of projectiles" by Hector J. McLeod, lecturer in electrical engineering; "The fourth dimension" by Professor Sheldon; "The gyroscope" by Professor Morrison; "Darwin's tidal theory" by George Robinson Gr.; "Short cuts in mathematics" by Professor Killam; "Some problems in aeronautics" by Charles A. Robb, Associate professor of mechanical engineering.

During the year 1915-16 Professor Morrison was president and Professor McLeod secretary.

The papers presented during 1915-16 were: "Life assurance problems" by Professor Killam; "The prismoidal formula" by Alex J. Cook '16; "Philosophy and mathematics" by Rupert C. Lodge, Instructor in mathematics; "The rotation period of Venus" by Ross S. Sheppard Gr.; "Finite and infinite numbers" by Professor Sheldon; "Electrical forces" by Russell E. Westberg '17; "Some

applications of mathematics in chemistry" by Alfred D. Cowper, assistant professor of chemistry; "Mechanics of mountain building" by John A. Allan, professor of geology; "The problems of the ether" by Professor Smith.

No meetings of the club were held during the years 1916 to 1919 on account of the fact that most of the members were in active war service. In the fall of 1919 it was decided to merge the Mathematical Club with the new Science Association which was then being formed and to carry on its activities as a section of the larger organization. Membership in the new organization is by election and is open only to members of the staff and to students doing graduate and research work.

The mathematical and physical sciences section meets every month for the presentation and discussion of papers. During the year 1919-20 Professor Killam was chairman and Professor Morrison secretary and during 1920-21 Professor Smith is chairman and Professor Cowper secretary.

THE MATHEMATICS CLUB OF FAIRMOUNT COLLEGE, Wichita, Kansas.

On October 26, 1920, a group of students of Fairmount College who were interested in mathematics organized, with the aid of the mathematics faculty, the Mathematics Club of Fairmount College. Active membership is limited to students who have taken or are taking differential calculus. At present the club has fifteen members. The officers are: President, Frank Isely '21; vice-president, Lucretia Switser '22; secretary-treasurer, Frances Brown '21; faculty adviser, Professor Arthur J. Hoare.

Meetings are held twice a month. Programs for the year are given below.

November 15, 1920: "My first impressions of calculus" by Donice Brees '22 and Harold Higgins '22; "What is mathematics and why do we study it?" by Castle Foard '21.

December 6: "Non-euclidean geometry" by Ellice Seelye '23 and Frances Brown '21.

January 3, 1921: "Logarithms and the slide rule" by Harold Higgins '22.

January 17: "Famous problems of antiquity" by Donice Brees '22.

February 7: "Theory of numbers" by Frances Brown '21.

February 21: "Hyperbolic functions" by Persis Lehman '21.

March 7: "Quaternions" by Castle Foard '21.

March 21: "Applications of mathematics to art" by Elizabeth Sprague, professor of fine arts.

April 4: "Celestial mechanics" by Lucretia Switser '22.

April 18: "Meaning of the symbol π " by Jesse Beams '21.

May 2: "Calculating machines" by Frank Isely '21.

May 16: Social and business meeting. Election of officers for 1921-22.

THE MATHEMATICAL CLUB OF THE JOHNS HOPKINS UNIVERSITY, Baltimore, Md. [1920, 478.]

We have already given some account of the record kept of the proceedings of the Johns Hopkins Mathematical Club. From that record the list of programs for the first half of the year 1920 are taken as given below.

March 24, 1920: "Calculation of amplifying and detecting properties of electron tubes" by Gregory Breit Gr.

April 7: "Formulae for the approximation of factorials" by Flora D. Sutton Gr.

April 13: "Prime factors in the quadratic domain" by Professor Abraham Cohen.

April 21: "An analytical treatment of the quadrilateral" by Frank V. Morley Gr.

April 28: This meeting was devoted to the solution of problems which had been proposed at previous meetings for solution and to the proposal of new problems.

May 5: "Quaternions" by Professor Frank D. Murnaghan; "Wilkinson's theorem"¹ by Frank V. Morley Gr.

May 12: "Induction motors" by Charles T. Zahn Gr.

May 19: "A self-dual Lüroth quartic" by Professor Frank Morley.

May 26: "The parabolic group of line-to-line transformations" by Dr. Tobias Dantzig, Instructor in mathematics.

A very noticeable feature of the work of this club, as the record of its proceedings shows, has been the proposal and solution of problems. Some part of the time at nearly every meeting has been devoted to this kind of activity.

PROBLEMS AND SOLUTIONS.

EDITED BY B. F. FINKEL AND OTTO DUNKEL.

Send all communications about Problems and Solutions to **B. F. FINKEL**, Springfield, Mo.

THE RELATION OF CAUSTICS TO CERTAIN ENVELOPES.

By OTTO DUNKEL, Washington University.

A number of problems have been proposed in the MONTHLY relating to the envelope of circles moving in a prescribed fashion.² Many such problems may be solved more simply by pure geometry than by the usual calculus procedure and it is desired to indicate here a method which is applicable in such cases and also to show how important facts may be learned by making use of caustic curves and their properties (see 1920, 225). Suppose that a variable circle rolls on a fixed curve Γ' while its center C remains on a second fixed curve Γ and that the envelope of the moving circle is to be studied. Let C and C' be the centers of two such circles touching Γ' in M and M' , respectively, and let $Q'P'$ be their common chord. Draw the diameters $Q'CK$, $Q'C'K'$. As C' approaches C the chord CC' approaches the tangent at C to Γ , M' and Q' approach M , and K and K' approach the extremity N of the diameter MCN . Since the angles $\angle KP'Q'$,

¹ Cf. MACKAY, *Proc. Edinb. Math. Soc.*, Vol. 11, 1893, p. 24; CASEY's *Sequel to Euclid*, 6th ed., p. 66, exs. 30, 31.

² For example problems 2819 (1920, 134); 2827 (1920, 186); 2861 (1920, 428); 2868 (1920, 482).